

Multi-system dynamics in the green hydrogen transition: the case of the German chemical industry

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Extended Abstract

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Abstract Summary

This study investigates the emerging role of green hydrogen within Germany's chemical industry, a sector critical to the national energy transition. While green hydrogen has gained significant policy momentum, empirical analysis regarding its integration across interconnected electricity markets and industrial systems remains limited. Adopting a qualitative approach grounded in the Multi-Level Perspective (MLP) framework, this research identifies the structural barriers and incentives shaping market development through 27 in-depth expert interviews. The analysis reveals that high production costs, primarily driven by volatile green electricity prices, and a deficit in comprehensive public funding remain primary obstacles. A key finding highlights Carbon Contracts for Difference (CCfDs) as a vital policy instrument, uniquely addressing economic viability gaps by covering operational expenditures (OPEX) where traditional funding often focuses solely on capital expenditures (CAPEX). Furthermore, the research uncovers complex interdependencies between hydrogen production and water resources, necessitating coordinated governance across the entire value chain. Notably, and contrary to common industry narratives, the interview data suggests that bureaucratic hurdles and permit applications held minimal significance for stakeholders compared to the overarching economic and systemic challenges. These findings underscore that the green hydrogen transition requires more than technological innovation; it demands synchronized policy frameworks that address both investment risks and operational costs while ensuring sustainable resource management.

Presenting Author Biography

Anna Lena Lesch is a Doctoral Researcher at the University of Göttingen, Germany, where she specializes in the systemic evolution of energy transitions. Her current work investigates innovative business models for utility companies, focusing on maximizing

household renewable adoption and optimizing grid infrastructure. This research builds on her foundational analysis of industrial-scale transitions, particularly the integration of green hydrogen within the German chemical industry. By bridging the gap between heavy industrial applications and decentralized residential systems, she seeks to identify the cross-sectoral regulatory and economic frameworks necessary for a cohesive energy future.